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NEWER OBSERVATIONS CONCERNING THE DETECTION OF BLOOD BY MEANS OF THE GUAIACUM REACTION.

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In a longer paper,[1] "On the Use of Guaiacum Resin as a Reagent," I have been trying, among other points, to recapitulate, as briefly as possible, the propositions of the last thirty years concerning the detection of blood with guaiacum resin, and with the so-called "Antozonides," viz., with peroxide of hydrogen or the analogous compound contained in isolated essential oils and acting like hydric peroxide. In this question the following memoirs are to be mentioned:

(1) *T. von Deen*, "Tinctura Guajaci u. ein Ozontiager als Reagens auf sehr kleine Blutmengen" (*Archiv. f. d. holl. Beitr. z. Naturw. u. Heilkunde.*, Utrecht, 1861-64, III, 228 to 231).

(2) *C. F. Schönbein*, "Ueber das Verhalten des Blutes zum Sauerstoff" (Erdmann's *Jour. f. pract. Chem.*, *89*, 22, "Sitzgsber. d. Münchener Akad., math. phys. Classe," 1863, II, 274).

(3) *F. L. Hünefeld*, "Die Blutproben vor Gericht, etc.," Leipzig, 1875.

(4) *H. Fahrner*, "Ueber den Nachweis von Blut mittelst der Guajak-Probe," Würzburg, 1876, Inaug. Diss.

(5) Lastly, a short paper of *D. Vitali*, which, however, I was not enabled to see in the original.

[1] *Forschungsberichte über Nahrungsmittel, Hygiene, Pharmakognosie u. forens. Chemie.* Herausg. von A. Hilger, München, 1896, Heft 1.

The importance of a trustworthy means of identifying blood or blood constituents like hemoglobin, methemoglobin and hematin in numerous judicial cases and the value of a combination, on many rather difficult occasions, of the spectroscopic test and of the methods of preparing the characteristic crystals of hemin (as described by *Teichmann*, *Hoppe-Seyler*, *Brücke* and *Preyer*), with the "ozone-transferring" action of the coloring matter of blood towards guaiacum, has induced me, for many years, to pay special attention to the last-named blood-test and to look for improvements of the hitherto known methods, which in some respects were far from being thoroughly satisfactory. As it happens in many cases, some accidental observations have led to the right way nearly as well as systematic experiments.

Many years ago (in 1866), after having attended the lectures of *C. F. Schönbein* (the chemist of Bäle, well known in England by his acquaintance with Faraday and other celebrated naturalists) and seen his experiments concerning the action of blood-cells on hydric peroxide and solution of guaiacum resin, I had gathered a series of experiences, which formed the chief content of a lecture held at Zürich (in 1875), but never published in print. The method then demonstrated having proved useful in a practice of almost thirty years, I could not hesitate to mention it in the above-named paper, "On the Use of Guaiacum Resin as a Reagent." The details of this method can be noted very briefly in this place, the more so as they may be found in the above-mentioned essay, and as the method has been communicated and discussed by *R. Otto*, in the supplementary part of his "Anleitung zur Ermittlung von Giften," etc., VII, Ed. (1897).

While the authors above referred to mainly recommended to mix the blood solutions—(obtained by extraction of a fresh or old blood-stain with small quantities of water, either alkaline or acidulated with acetic acid)—under suitable conditions first with an alcoholic guaiacum solution and then with transferable oxygen in the form of hydric peroxide or of the analogous compound contained in old and isolated turpentine oil (for instance, the liquid of Hünefeld, v. i.), and to observe the formation of the so-called "guaiacum blue," the method which I have proposed aims at the preparation of an intimate and durable mixture of the coloring matter of blood derived from the blood stain with guaiacum resin. This mixture

may be conserved for an indefinite time as a "corpus delicti," and at every moment strikes a very intense blue color by contact with one or another of the liquids containing loosely combined oxygen, provided that errors are cautiously avoided by check experiments. The proceeding, wanting but a short explanation in reference to the more explicit description in the paper quoted, chiefly consists in mixing the blood solution, obtained by extraction of blood stains, with an alcoholic solution of guaiacum resin[2] (or, as it has been lately proposed by *O. Döbner*, with a similar but weaker solution of guaiaconic acid), in which case a milky secretion results of the previously dissolved resin constituents, which, in these conditions, partly attract, fix and precipitate at the same time the dissolved or suspended coloring matter of blood (either in the state of hemoglobin and methemoglobin or of hematin). In this way a mechanical combination of the secreted resin with the said blood constituents is formed, which process reminds us in some way of the well-known method by which some ferments, like pepsin, are secreted by means of an indifferent precipitate caused in the ferment solution and afterwards extracted. If, then, we separate the precipitated resin (or the above-mentioned constituent acting as reagent) by thoroughly dense filters (especially the newer "hardened filters" of commerce), the hematin compounds are fixed on the surface of the filter in extreme division together with the particles of resin. These filters, when well protected from light and air even during the filtration process and then cautiously dried in the exsiccator, may then be conserved for any length of time. But a small piece of them is wanted, to cause in a few moments an intense blue coloration in a porcelain dish or watch glass on white paper, after it has been moistened with a little spirit of wine, and then a small quantity of Hünefeld's liquid (mixture of so-called "ozonized" turpentine oil with alcohol, chloroform and a little acetic acid) has been added. This process is equally applicable to blood stains, and to the detection of blood in urine, and other similar objects, and may be used as well for the research of relatively fresh blood, as for that of old dry stains, owing to the fact already

[2] It is preferable, in this case, to use a solution of about 5 per cent. of resin (instead of the alcoholic guaiacum tincture (1 to 2 per cent.) mentioned by *Schönbein* as the common reagent), in order to secure an easy secretion of resin in presence of small portions of blood.

observed by *Schönbein*, viz., that the coloring matter of blood altered by exsiccation even in higher temperatures still shows in unimpaired degree the different "ozone-transferring" properties, and even seems to act more intensely in some respects, for instance, towards a mixture of peroxide of hydrogen and cyanine.

Since the publication (in the quoted treatise) of this modification in the methods of detection of blood by means of guaiacum, some observations on different points of solubility of the red-colored blood constituents, especially in dry blood, have taken place, which lead to new propositions concerning a reliable, very short and direct way for the detection of blood, and therefore may be communicated in this JOURNAL, after having been briefly related in the pharmaceutical section of the annual meeting of German naturalists at Brunswick in 1897. By occasion of former studies and experiments on the physical and chemical behavior of chloral hydrate, which later on have been continued and extended by a pupil and assistant, *R. Mauch*, pharmaceutical chemist,[3] a special solvent power of highly concentrated, that is to say, 65 to 80 per cent., aqueous solutions of the said compound has been observed, not only for several bodies already known, like starch, but also for various very different substances, like certain resins, coloring matters, stearoptenes and also albuminous matters, especially the coloring matter of blood. In fact, experience showed that blood stains which have become dry even for a long time on linen or other similar materials are extracted in a relatively short time by impregnation and contact with a chloral hydrate solution of about 70 per cent. and more thoroughly dissolved than by any other treatment. Even blood stains many years old may, by this operation—after a somewhat longer contact with the solution—be removed to such a degree that their trace is but hardly discernible on the linen. It may be observed on this occasion that the solution of the blood constituents by aqueous chloral hydrate is much facilitated if the blood spots have been previously wetted with small quantities of concentrated acetic acid. The use of this acid is not only admissible for itself, as the guaiacum-blue is not affected by it, but even offers a certain advantage concerning a reaction of control to be mentioned later on.

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[3] C. f. "Ueber physikal.-chem. Eigenschaften des Chloralhydrates u. deren Verwerthung in pharm.-chem. Richtung." Inaug. Dissertat., Strassburg, 1898. In this paper a short chapter is also dedicated to the present question.

Inasmuch as guaiacum resin, as well as the guaiaconic acid, specially concerned in the formation of "guaiacum blue," are both easily soluble in the concentrated chloral hydrate solution, a simple method may be devised for the extraction of blood stains and the subsequent detection of the coloring matter of blood. This modification of the former procedures having led to identical results in all the numerous experiments executed for this purpose, I have no reason to wait any longer for the communication of a process which may sometimes prove a desirable supplement to the other methods for the detection of blood.

In fact, the guaiacum blood test can be prepared and managed on the simplest terms in this way, that first the colored spots in question, after moistening with a little acetic acid, are extracted either with a 70 per cent. chloral hydrate solution or directly with a 1 per cent. solution of guaiacum in aqueous chloral hydrate, containing 70 to 75 per cent. of the latter. In regard to the fact that the resin constituents concerned in the subsequent reaction show a marked tendency for spontaneous oxidation—as is sufficiently proved by the well-known change of color in the air and light—this latter method, on the whole, seems less preferable than the first named, which consists in *first extracting the blood* by means of chloral solution and then *adding to the resulting blood solution* about an equal volume of the guaiacum chloral solution. If in this process the blood stain has been moistened with acetic acid previous to the treatment with chloral hydrate, the addition of guaiacum chloral solution to the chloralic extract of the stain to be tested for blood will permit a control reaction, inasmuch as the casual presence of nitrites (as, for instance, nitrite of ammonia) in the respective stain would at once cause a more or less intense blue coloration of the mixture owing to the decomposition of these salts by the acetic acid, the nitrous acid coloring guaiacum, viz., guaiaconic acid blue even in high dilutions. Moreover, if the chloral extract of the stain contains only blood, the addition of the brownish-yellow guaiacum chloral solution to the pale red liquid derived from the stain will give a pale brown mixture exceedingly well adapted for a decisive zone reaction indicating the presence of hematin. To this blood guaiacum solution in aqueous chloral hydrate a stratum of the already mentioned turpentine solution of *Hünefeld* or of an adequate solution of hydric peroxide (*the indifference of which*

towards guaiacum tincture being previously stated) is carefully added without mixing; then an intensely blue and rapidly increasing zone appears, with extraordinary sensibility, in the place of contact and diffusion of the two solutions, while by sudden mixture a less pure blue coloration of the liquid results.

By the way, it may be mentioned that, after my experience confirmed by other observers, the method may also, in suitable cases, be so modified that the blood solution is first mixed with *Hünefeld's* liquid and then added to the guaiacum solution. This process can just as well be conducted to obtain a zone reaction or also a capillary reaction.

In cases of extraordinary small blood stains, so as to necessitate, in a certain measure, a microchemical operation, or where the respective residue of blood has to be tested on its natural place, it is advisable to digest the stain on a flat porcelain dish with strong chloral solution (v. s.), having first moistened with a small drop of acetic acid, and, after half an hour's contact, to pour on the digested spot first a corresponding small quantity of guaiacum chloral solution, and then, after having thoroughly mixed, a few drops of the one or other liquid containing the peroxide. With this method also a more or less intense blue coloration is seen to appear on the light-colored underground. Experience has shown me that even *very old* blood stains and exceedingly small parts of such may be identified in this manner, provided a sensible guaiacum chloral solution, prepared with quite fresh resin, and at the same time a liquid of *Hünefeld* or hydric peroxide solution of right composition[4] and controlled in regard to their activity are used. The zone reaction surpasses the other older methods of testing by special purity of the blue color resulting from the formation of the so-called "guaiacum blue;" besides that this purer color is more durable, according to the fact that in the measure of progressive mixtion of the active substances of the two layers (hematin as the oxygen-transferring body, hydric peroxide or essential oil as the source of oxygen

[4] A solution of *Hünefeld* suitable for the purpose may easily be prepared, mixing f. i. 15 c.c. of turpentine oil, exposed to light and air for a certain time (*but which ought not to change directly blue in the guaiacum tincture*), or 15 c.c. of a 3 to 5 per cent. hydric peroxide solution, free from acids, with 25 c.c. of alcohol, 5 c.c. of chloroform and 1·5 c.c. of glacial acetic acid.

and guaiaconic acid as the oxidable compound) small quantities of the intensely blue colored oxidation product are formed gradually. It is true, however, that the "guaiacum blue," especially in the presence of organic reducing agents, is not very stable, inasmuch as this compound, to use an expression of its first investigator, *C. F. Schönbein*, contains loosely combined, movable and active oxygen in the ozonide state.

The foregoing shows, as it seems, the usefulness of the modified guaiacum blood-test when cautiously applied; on the other hand, it cannot be denied that the reaction is liable to certain misinterpretations, in cases where some other organic or inorganic substances are present, instead of blood. It is scarcely necessary to mention in this place the numerous compounds which, as, for instance, nitrous acid, free chlorine, bromine and iodine, chromic anhydride, permanganic acid, peroxide of lead, the ferric and cupric salts, quinone, etc., *directly* color blue the guaiacum resin; because, first of all, many of these bodies are exempted *a priori* in the majority of materials submitted to the blood-tests, and secondly, because in their presence the liquid extract of a stain to be tested for blood would *at once* strike a blue color when mixed with a little guaiacum tincture *before the addition of Hünefeld's peroxide-solution.* In regard to these facts, the somewhat superficial notice of some text-books, viz., that the guaiacum blood-test is not reliable, "because many substances change guaiacum for themselves," cannot be taken as a warning against the use of the said method, since, certainly, no careful analyst will ever neglect to avoid mistakes by availing himself of the control-reactions indicated in each case! Yet, such substances of inorganic or organic origin, as share the "ozone-transferring" quality with the contents of the blood cells, viz., the coloring matter of blood, might in some single cases lead to a false interpretation of the guaiacum-blue-reaction. Among organic vegetable substances, bodies of the class of ferments may be named, as well as hydrolytic ferments (enzymes in the stricter sense of the word) chiefly so-called oxidizing ferments, as they occur in numerous parts of plants, especially in mushrooms and plant seeds, while among animal substances in the first line saliva, extracts of some organs, the contents of white blood cells and pus cells, etc., show analogous properties. These albuminous substances of the character of ferments, existing in vegetable and animal cells, and exerting in a more or less mani-

fest degree a catalytic and, at the same time, "oxygen-transferring" action towards hydric peroxide, strictly differ from the coloring matter of blood in that the last-named action is cancelled, or at least most strikingly weakened by heating to 100° C., or also by contact with diluted hydrocyanic acid! In case the extract of a pretended blood stain contains such a substance of the class of ferments, instead of the ingredients of blood, it will cease to show the guaiacum-reaction, even after a shorter digestion at the temperature of the water-bath, and also a control-experiment *with addition of hydrocyanic acid during the extraction* of the stain will give essentially negative results.[5] However, the avoiding of every mistake becomes rather difficult in such cases, where the presence of even the smallest quantities of ferrous oxide or other ferrous compounds can occur, as, for instance, in the testing of suspected stains on rusty iron materials. If the rust, even in the absence of blood, contains small portions of certain ferrous compounds, viz., ferrous carbonate or other ferrous salts, they could, by extraction, be introduced into the filtered solution, even in case the latter had not taken up any ferric hydrate or basic ferric salt; yet such an extract of a stain, even with the slightest trace of ferrous oxide, would cause the guaiacum-blue-reaction after subsequent addition of guaiacum resin and hydric peroxide. A strict distinction of ferrous oxide and of the coloring matter of blood is not very easy in such cases, because the first-named compound, even in smallest quantities, manifests the same intense "ozone-transferring" power as hemoglobin or hematin, which also contain iron. It will, therefore, form the object of further experiments to find out how the mentioned casual mistaking in the guaiacum-blood-reaction may be eliminated. On occasion of such further researches concerning the reaction discussed in this paper, the question would have to be treated, whether blood, which, after drying up in slow decomposition on certain materials, like stone, clay and rough metallic surfaces, and after disappearance of the organic substance by the action of air and water, leaves but rusty spots, can generate in these conditions seizable quantities of ferrous compounds.

The above-described method of extraction of blood stains with

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[5] For further particulars concerning this question see Ed. Schaer's "Contributions to the Chemistry of the Blood and the Ferments," *Zeitschr. f. Biologie*, Vol. VI (1870), p. 467.

concentrated solutions of chloral hydrate which, as is well known by this time, are also good solvents for resins, has induced some experiments in order to ascertain whether, by using the process mentioned in the first part of this essay, chloral solutions containing blood and guaiacum may, by precipitation with water and subsequent filtration, give a resinous secretion containing blood constituents, showing the mentioned behavior and applicable to the guaiacum-blood-reaction after any time of conservation. It may here be stated, by the way, that the trials performed in this manner have but led to a moderately satisfactory result, probably because even a diluted chloral-solution still acts as a solvent on the resin in a low, but perceivable degree and besides, as I am induced to believe, because the coloring matter of blood is less easily precipitated by the secreting resin from a chloral-blood-solution than from a chiefly aqueous liquid. But, notwithstanding the loss of material caused in that way, by the use of this method resin-covered filters can be obtained possessing the properties quoted in the beginning of this paper.

Lastly, it may be mentioned that—as it could be expected—the guaiacum blood-test executed with chloral solution is thoroughly applicable to a control-reaction, viz., to the chemical identification of the hemin-crystals, which are of high importance in judicial cases. A specially pure blue coloration is obtained, when, instead of the ordinary guaiacum-solution, a solution of guaiaconic acid in 200 to 500 parts of chloral-solution (v. s.) is used, and the reaction is observed in a glass tube as a zone-reaction. The guaiaconic acid, proposed as a substitute for the natural resin by *O. Doebner*[6] in his interesting essay on guaiacum resin and "guaiacum-blue," is just as well liable to spontaneous oxidation in light and air with changes of color; and, according to my observations, its use is more convenient for the described zone-reactions than for experiments in watch glasses or dishes, where greater surfaces get into action. It is, moreover, obvious that this special experience cannot interfere with the certainly desirable use of the guaiaconic acid, as being the active constituent of the resin, in the numerous other guaiacum-reactions. I cannot but feel convinced that the reactions with guaiacum resin have not, in all respects, met with the consideration

[6] See *Archiv. d. Pharmacie*, 1897.

they deserve, neither in general nor in medical and pharmaceutical chemistry, so I thought it advisable to publish this little contribution to the question in this convenient place.

STRASSBURG (GERMANY) PHARM. INSTITUTE UNIVERSITY,
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THE OIL AND TERPENES OF ARALIA NUDICAULIS.[1]

BY WILLIAM C. ALPERS, SC.D.

The specimens of Aralia Nudicaulis subjected to chemical analysis were gathered by the writer in the hilly woods of Bergen County, N. J., near the banks of the Passaic River. When freshly collected, the rhizome contains from 40 to 60 per cent. of moisture, according to the age of the plant and the time of collection. After drying in the air and afterwards at a temperature of about 100°, the drug was finely powdered, and all the following calculations are based on this dried sample. The quantity of ash obtained on incineration varied in younger and older specimens from 5 to 6 per cent., giving an average of 5·53 per cent. Nearly one-fourth of this, or 1·38 per cent. of the original dry sample, consisted of soluble chlorides and sulphates of sodium and potassium.

A number of preliminary examinations, made by extracting the organic matter with various solvents, had shown that the solvent, generally employed first, after Parson's method, namely, chloroform, would dissolve all the oils and resins contained in the plant; but great difficulties were encountered in separating the fixed oil and some of the resins. It is owing to this fact that, in a paper by Alpers and Murray (see "Proceedings American Pharmaceutical Association," 1897), the fixed oil was overlooked and classified as resin. As these preliminary examinations further showed that petroleum-benzin would dissolve the oils, but hardly any of the resins of the plant, it was deemed advisable to use this solvent first, and employ in general the method recommended by Dragendorff in his "Plant Analysis." Therefore, 250 c.c. of the drug were digested with petroleum-benzin in a narrow cylindrical percolator, covered with the solvent and allowed to macerate for eight days. The petroleum-benzin used for this purpose had previously been

[1] Extract from the thesis for the doctorate at the New York University.

treated with sulphuric acid, and was distilled at a temperature below 75°. After maceration, percolation with the same solvent was continued, until the percolate failed to show any reaction with the commonly employed reagents for oils, resins, alkaloids, etc. The percolate was then evaporated at a temperature below 75°, leaving a dark-red, thick liquid. The remaining drug, after the extraction with petroleum-benzin, was thoroughly dried and macerated with anhydrous ether, that had previously been distilled over sodium. After eight days the ether was drawn off and the drug washed three times with the same solvent. After distilling off the larger part of the ether, the remainder was allowed to evaporate spontaneously, leaving behind a resinous mass weighing 2·253 grammes. This mass was treated with petroleum-benzin in order to extract whatever might have escaped the first solvent, and a loss of ·275 gramme was noted. This value was added to the benzin extract previously determined, leaving 1·978 grammes of ethereal extract; to this must be added that part which was afterwards gained from the alcoholic extract, namely, 1·223 grammes, making a total of 3·201 grammes, or 1·280 per cent. This ethereal extract, which before treatment with petroleum-benzin was rather soft, was now hard and brittle and could easily be pulverized. It was treated at ordinary temperature with cold water, which failed to dissolve any of it. The ethereal extract, after drying again, showed no loss of weight. It was then treated with absolute alcohol, which dissolved the larger part of it, leaving a residue of ·107 gramme, or ·043 per cent. of the original drug. This residue, soluble in ether, insoluble in petroleum-benzin, absolute alcohol and water, consists of a fine dark powder, of neutral reaction, indifferent to the common reagents, forming no combination with metal-salts, and may be called an indifferent resin or resin-anhydride (Dragendorff, "Plant Analysis"). The part of the ethereal extract, 3·094 grammes, or 1·237 per cent., of the drug, soluble in absolute alcohol, is hard and brittle, of a light-brown shining color, has an acid reaction, and forms compounds with most metals. With ferric salt a dark-green color is produced, turning red on addition of potash solution and then yellow on addition of hydrochloric acid. Ferrous salts give no color reaction. Lead acetate, cupric acetate, silver nitrate and other salts are decomposed by it. A slight precipitate is also formed by a solution of gelatine. It is, therefore, an acid resin, with the admixture, probably, of a small amount of tannic acid.

The residue of the drug, after extraction with petroleum-benzin and ether, was again dried and treated with absolute alcohol in a cylindrical percolator. After maceration for seven days, percolation was continued to exhaustion. A part of the percolate was evaporated at a temperature below 50°, and from the residue the total amount of alcoholic extractive was calculated to be 6·052 grammes. This extract was then treated with petroleum-benzin, which failed to dissolve any of it. It was then treated with ether, suffering a loss of 1·223 grammes, as previously stated. The remainder weighed, therefore, 4·829 grammes, equal to 1·931 per cent. of the original drug. This alcoholic extract gave all the common reactions for tannin. There were, however, also indications of an organic acid, the nature of which was not determined. Besides these, a small amount of an acid resin, similar to the one of the ethereal extract, was present.

The extract of each solvent was examined by a series of tests for alkaloids, without showing traces of any.

The following is a summary of the three extracts:

Extract with	Percentage of dry drug.	Containing
Petroleum-benzin	1·726 per cent.	mostly fixed oil; volatile oil from ·04 to ·12 per cent.
Anhydrous ether	1·280 per cent.	·043 per cent. indifferent resin; 1·237 acid resin.
Absolute alcohol	1·931 per cent.	mostly tannin; some acid resin and probably an organic acid.

CHEMICAL EXAMINATION OF THE OIL.

The extract, gained by treating the drug with petroleum-benzin, adding to it the parts dissolved from the ethereal extract, weighed in toto 4·316 grammes, equal to 1·726 per cent. of the drug. On exposing it to a heat of 110° a slight loss of weight was experienced owing to the evaporation of the volatile oil. As this latter forms a variable constituent, as will be shown later, no account of the amount evaporated was taken.

THE FIXED OIL.

The fixed oil is perfectly clear, of a dark red color, soluble in petroleum-benzin, benzin, ether and chloroform, sparingly soluble in absolute alcohol, insoluble in alcohol and water. It has a bitter, acrid, pungent, lasting taste, causing a feeling of dryness in the

mouth, and reminding of the peculiar fragrance of the fresh rhizome; its odor resembles castor oil slightly. At ordinary temperature it is rather thick, solidifies at 3° and decomposes at about 300°; efforts to distil it in vacuo were not successful. Its specific gravity is ·921 at 20°. Under the influence of nitrous acid it solidifies, forming a grayish-yellow, sticky, doughy mass of elaidin.

For further identification the acid, saponification, and iodine figures were determined after Benedict, "Die Analyse der Fette," with the following results:

Acid figure	7·39
Saponification figure	192
Iodine figure	106

By boiling the oil with alcoholic potash solution, made by dissolving 57·0 potash in 430 grammes 40 per cent. alcohol, using a reflux condenser, a dark brown soap was prepared; by extraction with ether a small amount of crystallizable alcohol was obtained, which by recrystallization from hot alcohol could be purified. There was, however, too little of it to subject it to further examination. The soap was decomposed with tartaric acid, and the separated oily acid extracted with ether. The remaining aqueous liquid, containing principally potassium tartrate, was carefully evaporated and yielded by means of ether-alcohol a sweetish alcohol, soluble in water. By heating this alcohol with potassium hydrogen sulphate the characteristic odor of acrolein was evolved. A borax bead immersed in this alcohol imparted a green color to a non-luminous flame. This water-soluble alcohol was therefore recognized as glycerin.

The fatty acid gained from the soap readily forms compounds with most metals. Its lead salt was soluble in ether, and from this fact and the elaidin test previously mentioned it was recognized as consisting principally of oleic acid.

An observation of the depression of the freezing point of this fixed oil was made in the following manner:

Benzol was used as a solvent and Beckmann's apparatus employed. The oil being too thick to be introduced into the small side tube, a solution of known percentage in benzol was used instead of the pure oil, and two different observations with solutions of different percentages were made. The first depression of the freezing point was ·153°, the second ·323°, from which the calculated molecular weight resulted as 907 and 914, after the formula

$$M = \frac{K \times P}{D},$$

K being the constant for benzol, P the percentage of the oil in the solvent and D the depression of the freezing point. As the same apparatus with the same benzol was used in both experiments, it was to be expected that the figure of the second determination would be a little higher than the one of the first determination, as the evaporation of some benzol could not be prevented, and the solution had therefore a higher than the calculated percentage. From the elaidin test, previously mentioned, the presence of olein was indicated, and from this fact and the calculated molecular weight (907 +) it appears probable that the larger part of this oil consists of triolein, $C_3H_5(C_{18}H_{33}O_2)_3$ (molecular weight, 884).

As the summary of the investigations of the fixed oil of aralia nudicaulis, the following is presented:

Dark red color; specific gravity, ·921 at 20°; soluble in petroleum-benzin, benzin, ether, chloroform, sparingly soluble in absolute alcohol, insoluble in alcohol and water; acrid, pungent taste, slightly resembling castor oil in flavor. At ordinary temperature thick, not drying, solidifying at 3°, forming elaidin with nitrous acid; acid figure, 7·39; saponification figure, 192; iodine figure, 106; molecular weight, about 900; constitution, largely triolein, $C_3H_5(C_{18}H_{33}O_2)_3$.

THE VOLATILE OIL.

Together with the fixed oil, the petroleum-benzin dissolved a small quantity of a volatile oil, the presence of which in the plant had already been established by the microscopical examination of the bark of the rhizome. In order to obtain a larger amount of this oil, 50 kilos of finely powdered aralia were distilled with steam. Owing to the absence of convenient apparatus, this work was done at the pharmaceutical laboratories of Lloyd Brothers, Cincinnati, O., through the kindness of Prof. John Uri Lloyd. Two different lots of 50 kilos each were distilled at two different times, the first in the fall of 1897, the second in the fall of 1898. In both cases the drug was expressly gathered by competent root collectors and examined as to its purity by the writer. The process of distillation was described by Professor Lloyd as follows:

"Fifty kilos of the fresh root were ground coarsely and put in a

tinned copper still connected with a tinned worm. The drug rested on a perforated tinned diaphragm. Steam was conducted beneath the diaphragm and allowed to slowly pass into and through the powder, finally reaching the condenser, from which the condensed water was run into a 100-gallon glazed stone jar. Every part of the apparatus was perfectly clean and kept closely covered during distillation. The distillation continued for four days, the oil being skimmed from the water daily. The operation was finished when 100 gallons of distillate had been obtained, it being then shown that no additional oil appeared. The oil-saturated water was then shaken, a portion at a time, with chloroform, the chloroform being separated from each portion and used to abstract each succeeding portion. The chloroform solution and essential oil were contained in the two bottles sent you, and close investigation of the drug in the still demonstrated that no oil remained with it. The condensed water that trickled from the drug gave no evidence of volatile oil.

"During the period of distillation, a separate portion of the steam used was condensed in order to determine that no oil passed from the boiler. It gave clean condensed water."

The quantity of oil gained at the two distillations varied greatly; in 1897 about 60 c.c., or ·12 per cent., were obtained, while the second yield was only about 20 c.c., or ·04 per cent. Concerning this difference Professor Lloyd writes:

"I pushed the distillation to the utmost limit, carrying it as far as any yield whatever of oil could be observed, and the difference in the amount I obtained this time and that I obtained before lies in the variation of the quality of the drug. Now, inasmuch as the drug was dug by the same party each time and the same time of year and in the same locality, the variation results from the different quality of the drug, for the manipulation was exactly the same in both instances. I will add that I am not at all surprised at the outcome, for my experience in indigenous drugs is to the effect that such variations are to be expected. They result from local conditions, such as drought, atmospheric influences, etc., and they are to be expected rather than not expected."

After the oil of aralia, as received from Professor Lloyd, had been freed from chloroform by distillation, it was dried over calcium chloride. This oil had a peculiar pleasant aromatic odor, resembling young carrots, and was of a clear light yellow color.

It was then subjected to repeated distillations at reduced pressure of 80 millimetres. By far the larger portion distils at this pressure at a temperature of 185° to 195°; at normal pressure the boiling point is from 260° to 270°.

After a series of tests for nitrogen, sulphur and halogens, showing the absence of these elements, a number of combustions were made with the following result:

	C. Per Cent.	H. Per Cent.	O. (By subtraction.) Per Cent.
1.	86·24	11·52	2·24
2.	86·28	11·47	2·25
3.	85·95	11·58	2·47

While the proportion of carbon and hydrogen seemed to indicate the presence of a terpene, $(C_{10}H_{16})_n$, it was clear from the calculated oxygen that at the same time a compound containing this element, probably an alcohol, was mixed with it. All efforts to separate these two or more substances by fractional distillation were futile, the boiling point gradually rising from 260° to 270°, when the last particle would pass over, without showing any indication of accumulation at any particular point. It became, therefore, necessary to adopt chemical methods for their separation; this could be done only with the greatest care owing to the small quantity disposable. After several unsuccessful efforts, metallic sodium was added to the oil, causing a lively reaction with generation of hydrogen, the sodium combining with the substance or a part of it. The whole mass became thick and gelatinous, and it was then supposed that polymerization had taken place. At this point the investigation was interrupted for a number of months. After this time it was observed that the gelatinous mass consisted of two parts of different aggregation, and for their separation distillation at a pressure of 80 millimetres was undertaken. At this pressure a perfectly colorless oil of a strongly aromatic odor distilled over at a temperature of 189°, comprising more than two-thirds of the previous quantity. The remaining fraction showed the presence of sodium.

On raising the temperature still higher at ordinary pressure, a few drops of a clear blue oil were obtained, at a temperature of about 300°, probably azulene of the formula $C_{16}H_{26}O$ (boiling point, 302°).

The clear oil was redistilled at ordinary pressure, and a steady boiling point of 270° observed. Elementary analyses resulted as follows:

	Found. I.	II.	Calculated for $(C_{10}H_{16})_n$
C =	88·22	88·21	88·23
H =	11·62	11·70	11·77
	99·84	99·91	100·00

Here, then, the oxygen was eliminated, and the nature of a terpene established for the oil.

In order to ascertain the molecular weight a vapor density determination after Victor Meyer's method was made. The amount of oil under examination was ·0269; anthracene was used in the outer bath, as it was necessary to obtain a temperature of over 270°. After volatilizing the oil, a volume of gas of 6·8 c.c. was observed at a temperature of 21·5°.

After making the necessary corrections as to pressure and temperature, a molecular weight of 198·36 was calculated. Taking the formula $(C_{10}H_{16})_n$ and making $n = 1\frac{1}{2}$, *i. e.*, $C_{15}H_{24}$, we have:

$C_{15} = 15 \times 12 =$	180
$H_{24} = 24 \times 1 =$	24
Together	204

This figure agrees within the limit of experimental error with the figure 198·36, so that the nature of a sesquiterpene, $C_{15}H_{24}$, is established for this larger part of the volatile oil of aralia nudicaulis.

The following color tests were observed: One drop of the sesquiterpene dissolved in 5 grammes of chloroform showed, on addition of one drop of sulphuric acid, a purple red color, gradually turning darker. One drop dissolved in 5 grammes of glacial acetic acid showed, on addition of one drop of sulphuric acid, a light wine-red color, darkening on standing. In both cases the darkening of the colors was accelerated by addition of more sulphuric acid and on warming.

One part of the terpene was dissolved in three parts of glacial acetic acid and mixed with equal parts of glacial acetic acid previously saturated with dry hydrochloric acid. A rose color was observed, gradually turning purple, and later, in about ten minutes, a beautiful sky-blue. This color remained permanent. On distilling this blue compound in vacuo, a blue liquid passed over at 140°, too small a quantity, however, to subject it to further examinations.

The sesquiterpene was dissolved in three parts of ether and dry hydrochloric acid gas conducted into the mixture, which soon turned purplish-red, gradually growing darker, almost black. The

ether was then allowed to evaporate, leaving a dark addition product of a thick oily consistency ($C_{15}H_{24}$·HCl); crystals could not be obtained. By treating this hydrogen chloride compound with a solution of sodium acetate the sesquiterpene was regenerated.

A bromine addition product was obtained in the following way: One volume of the oil was dissolved in a mixture of four volumes of alcohol and ether, and one volume of bromine dissolved in the same menstruum added, keeping the mixture cool. After evaporating the alcohol and ether a dark green substance ($C_{15}H_{24}Br$) was obtained, insoluble in alcohol, soluble in ether. Efforts to crystallize it were not successful.

The boiling point of the oil, after making the necessary corrections as to pressure and temperature of the laboratory, was found to be 270°. Its specific gravity is ·9107 at 18° and ·9086 at 20°. Its index of refraction at 18° is $N_{[D]} = 1{\cdot}49936$.

To determine its influence on polarized light, a solution in benzol had to be used, as not a sufficient quantity of the oil was at hand to fill the tube of the apparatus. The following observations were made:

Percentage of Solution.	Density.	Observed Angle.	[α]D
37·08	·8904	— 4·9°	— 7·42
27·57	·886	— 3·5°	— 7·20

These two observations agree fairly well, showing that the substance is laevo-rotatory and $[\alpha]_D$ between — 7 and — 8.

Efforts were made to obtain a crystallizable derivative, by employing various methods as described by Wallach and others, but without success. Nitroso- compounds were formed of an oily appearance. The following is a summary of the investigation:

The volatile oil of aralia nudicaulis consists principally of a sesquiterpene, $C_{15}H_{24}$, and an alcohol, $C_{15}H_{25}OH$ (?); a small quantity of azulene is also present. The sesquiterpene has a specific gravity of ·9086 at 20°; boiling point, 270°, $[\alpha]_D = -.7$ to — 8; $N_D = 1{\cdot}49936$. It forms oily compounds with HCl and Br, and derivatives with nitrous acid. Treated with hydrochloric-acetic acid it forms a compound of a permanent blue color. Chloroform and sulphuric acid produce a purple red color, acetic acid and sulphuric acid a wine-red color.

According to these reactions and properties, this sesquiterpene differs from those isomerous compounds that have been identified and the name *Araliene* may be proposed for it.

ON DIGITOXIN AS THE ACTIVE PRINCIPLE OF DIGITALIS.

By Joseph W. England.

It is not the writer's intention to endeavor to solve the many perplexing statements that have been made, especially in recent years, regarding the exact chemical nature of the proximate principles of digitalis leaves. But there is one matter that should be set right by pharmacological data, and that is the clear impossibility of *digitoxin* being the dominating therapeutic principle of digitalis, as has been claimed.

Since Schmiedeberg wrote his paper on the subject in 1875 (*Arch. exp. Pathol. un. Pharm.*, 3, 15), the accuracy of his work on the chemical composition of digitalis leaf has not been questioned, until recently.

Kiliani reported, in 1892 (*Archiv. der Pharm.*, 230, p. 250, *vide Pharm. Jour. and Trans.*, June 25, 1892, p. 1061, Am. Jour. Pharm., 1892, 415), that "the digitalin of Schmiedeberg is a distinctly individual substance which possesses, in a marked degree, the characteristic property of acting upon the heart." Further, he said: "Analysis gave results agreeing with those obtained by Schmiedeberg, which lead to the formula ($C_5H_8O_2$). This agreement may be taken as strong evidence that Schmiedeberg's digitalin was a chemically individual substance. However, the best support of this view is furnished by the behavior of digitalin with dilute hydrochloric acid. The substance is thus split up very definitely into digitaligenin, glucose and digitalose. When pure digitalin is used, the first-named product separates at once in fine crystals, but when the material operated upon contains some of the other glucosides, the digitaligenin cannot be made to crystallize at all, or only by very tedious operations."

In 1892 Kiliani reported (Am. Jour. Pharm., 422) upon the pharmacological testing made by Professor Boehm, of Leipzig, with Schmiedeberg's digitalin.

Professor Boehm found that this digitalin, administered to frogs in 0·5 milligramme doses, produced systolic stoppage of the heart after fifteen to twenty minutes. Intravenal injection of 2 milligrammes in dogs caused increase of blood pressure with reduction of the frequency of the pulse and the increase of its volume. Double the

dose caused arhythmia, and after a short time sudden cardiac arrest. The same effects were produced on cats. Rabbits were found to be less sensitive. At the place of injection no inflammatory change could be detected. Human subjects under the care of Dr. Mottes, of Munich, gave physiological effects without the occurrence of disagreeable or dangerous symptoms. Professor von Ziemssen also tried the digitalin in the Munich Hospital, and obtained very good results.

After this, however, Kiliani radically changed his views and claimed that Schmiedeberg's active principles were, in several instances, impure products, that is, mixtures; that digitalis *leaves* contained neither digitonin nor digitalin, but the glucoside digitoxin; that the glucosides digitalin and digitonin are present in the *seeds*, but not in the leaves, and that digitonin is quite insoluble in water, and that the existence of digitalein is extremely doubtful. In other words, that digitoxin is the only important constituent of digitalis leaf (*Archiv. d. Pharm.*, 1892 to 1896, inclusive, through *American Druggist*, 1897, 68).

In 1895 (*Arch. d. Phar.*, 1895 (No. 4), 311, 320, *vide* A. Ph. A. Proceedings, 1896, 825) Kiliani reported obtaining from digitalis leaves a substance identical with, or closely related to, the digitoxin of Schmiedeberg, and provisionally termed it *b* digitoxin. It was present to the amount of 0·1 per cent., was alleged to be a glucoside, and was obtained in a crystalline state. In 1896 Kiliani reported (*Arch. d. Pharm.*, 234, No. 7, September 10, 1896, 481, 489, *vide* A. Ph. A. Proceedings, 1897, 735) that experiments had shown that Schmiedeberg's digitoxin and the digitoxin which he had isolated during the previous year, and provisionally named *b* digitoxin, were positively identical.

In 1897 C. C. Keller's conclusions (*Berichte d. Deutsch. pharm., Gesellsch.*, 7, 125, *vide Pharm. Journal, vide* A. D., August 10, 1897, 70) on the subject of the chemical principles of digitalis leaves were that they contain a digitalin, a digitoxin and a digitonin identical with products from digitalis seeds, but in somewhat different proportions, the amount of digitoxin in the seeds being much smaller than that in good leaves, but varying much in different samples of leaves, or from 0·26 to 0·62 per cent. Keller writes that the unsatisfactory results obtained with the digitalin prepared according to the method described by Kiliani (see *Pharm. Journal*,

55 (1896), 29) have again attracted attention to digitoxin, which latter is alleged to be the most potent constituent of digitalis leaf, and then makes a plea for standardizing digitalis preparations on the basis of the amount of digitoxin they contain.

Replying to a criticism by Keller, of his results of investigation concerning the constituents of digitalis leaves, Kiliani claims that digitalis leaves contain, besides digitoxin, a crystallizable glucoside in considerable quantities, which, like digitoxin, is soluble in chloroform, and which also produces, with solution of iron in glacial acetic and sulphuric acids, the blue color regarded by Keller as characteristic of digitoxin. Kiliani proposes for the new substance the name of digitophyllin, and gives its physical and chemical properties (*Arch. d. Pharm.*, Aug. 17, 1897, 525–429, *vide* Proc. A. Ph. A., 1898, 795).

Professor Boehm, while in general acknowledging the value of Keller's method for the estimation of digitoxin, warns against an absolute reliance upon it, as, in his opinion, the efficacy of digitalis depends not alone on the digitoxin present, but rather on the sum total of all its constituents (*American Druggist*, June 25, 1898, 342; from Gehe & Co.'s *Bericht*).

According to Kiliani, the leaves of digitalis contain neither the so-called *Digitalin verum* (*i. e.*, Schmiedeberg's digitalin) nor digitonin, while Keller (Ueber die Wertbestimmung von Drogen und galenischen Praparaten. Diss. Zurich, 1897) states that *digitalin* and *digitonin* are present. M. Cloetta has gone into this knotty problem, and finds that the leaves, as well as the seeds, contain *digitalin*, *digitoxin*, *digitonin*, and *coloring matter common to both*. He did not find any *digitalein* in the leaves. The seed contains much more *digitalin* than *digitoxin*, while the leaves contain less (1898, *Arch. exp. Pathol. u. Pharm.*, *41*, 421, *vide* Am. Jour. Pharm., 1899, 90).

From this it will be seen how hopelessly at variance the authorities are upon the subject of the actual chemical nature of the proximate principles of digitalis leaves.

There is one phase of the controversy, however, which may be profitably considered. If it be true that digitoxin represents the medicinal virtues of digitalis leaf, it follows that it should give clinically all the therapeutic results yielded by the leaf or its preparations, and as promptly. Further, if this is so, it is apparent, since digitoxin is wholly insoluble in water, that the infusion

of the leaf is wholly destitute of the representative principle of the leaf, and consequently of medicinal worth; yet there are physicians who use the infusion of the leaf to the exclusion of its other preparations. Against this fact it is contended (*Pharmaceutische Rundschau*, 1898, 603, *vide* AM. JOUR. PHARM., 1899, 145) that, while "pure digitoxin is insoluble in water, yet from the infusion of digitalis considerable quantities are obtainable," and in explanation of this seeming paradox it is claimed that the other glucosides of the leaf form *digitoxin on its digestion with water*. But how this makes water-insoluble digitoxin soluble in water is not explained. The infusion made by *cold* water maceration (which can contain no digitoxin) is better clinically, in the writer's experience, than the hot water product (A. J. P., 1892, 361).

Now, without denying that digitoxin may be the most distinctive *chemical* substance in digitalis leaf, it is very clear, from the recently reported experiments of Dr. Karl Hofmann (*Wiener klinische Wochenschrift*, 1896, No. 42, 939, *vide The American Journal of the Medical Sciences*, 1897, 107), and the pharmacological results previously given by the writer in this journal, that the entire therapeutic activity of the leaf cannot be due to digitoxin.

Dr. Hofmann reports results had with the use of digitoxin in fifty-nine cases—three instances by the mouth, thirty-seven by subcutaneous injection and nineteen by enemata. He confirms previous investigators in referring to its insolubility in water and the vigorous local irritation caused by its use. The injections are followed by local burning pain, lasting from one-half to three or four hours, and redness for two or three days, which is sensitive to pressure. Inappetite, nausea, vomiting and pain in the epigastrium occurred in one-fourth the cases, whether subcutaneous injections or enemata were administered. The most remarkable fact, however, was the *length of time* reported as having elapsed before physiological effect was manifested. After the first dose, six hours were required to increase pulse-force and lessen dyspnœa, while twelve hours were required to produce diuresis. With enemata these changes required twenty-four to thirty-six hours.

From a therapeutic point of view, it is clearly impossible to believe that a drug or preparation that yields physiological effects in about thirty to sixty minutes has for its most important constituent a proximate principle, whose physiological effects are not manifested in from six to thirty-six hours.

Without discussing Kiliani's claims as to the absence of digitalin, digitonin and possibly digitalein in digitalis leaf, it seems clear from Hofmann's experiments with digitoxin—its difficulty of absorption, the length of time necessary to yield cardiac and renal effects, its slowness of elimination and the relative rapidity of absorption of digitalis tinctures—all preclude the acceptance of Kiliani's claim that digitoxin is the most important therapeutical principle of digitalis leaf.

The severe local pain following hypodermic injections of digitoxin, the prolonged sensitiveness of injected tissues and the slowness of physiological effects indicate a great difficulty of absorption and assimilation, so much so that one is led to ask the question: "Is it not probable that the water-insoluble digitoxin is absorbed not as digitoxin, but as water-soluble decomposition product or products?"

Digitalis is sometimes cumulative in action. When taken for a long time there are occasionally exhibited symptoms without any increase in the use of the drug. This has been thought to be due to the fact that the proximate principles of the drug were not excreted by the kidneys as fast as absorbed, and that they therefore accumulated in the body. But from the experiments detailed above, and in my paper on Tincture of Fat-free Digitalis, it would seem to be more reasonable to believe that cumulative action, where existent, is due to the slow absorption and elimination of digitoxin. With a bed-patient, a good tincture of digitalis, for example, should yield primary effects in from 15 to 30 minutes, and full effects in from 45 to 60 minutes. Digitoxin, however, on hypodermic injections, requires, before any effects are shown, 6 hours and over. Now, if a large number of doses of a digitalis tincture are given, and the use of the drug is withdrawn, may not the accumulated digitoxin (of the tincture) by absorption give rise to the dangerous symptoms which are called the cumulative effects of digitalis?

ARTIFICIAL FOODS; WHY THEY EXIST AND WHAT THEY ARE.

By J. Percy Remington, B.S. (U. of P.).

In this paper an endeavor will be made to discuss, in a practical manner, the subject of Artificial Foods, touching upon the reasons

for their existence, the principles of their use, the composition and manufacture of the various kinds, and the great possibilities which are open to this comparatively new form of nourishment which is now occupying so much of the attention of the medical men and scientists of the world, and the utility of which we are just beginning to realize.

Artificial foods so far have found their greatest use as a substitute for human milk in infant feeding, and although they are sometimes used in diseases of adults, yet, since there are many other forms of diet which can be employed in such cases, they have not found as extensive an application in this field.

It is a well-known fact that among the more cultured classes mothers frequently do not have a sufficient quantity of milk to suckle their young, whereas among the poorer classes, for instance, the peasant women of France and Germany, this statement does not hold true, and it has been this fact that has forced us to find some substitute which could take the place of human milk and supply all those ingredients which are necessary for the perfect development of the young.

The belief has been entertained that a paper on this subject would be of interest to the Pennsylvania Pharmaceutical Association at this time, because pharmacists are probably more frequently consulted by parents than even physicians, and the future welfare of our race, in a measure, depends upon the raising of the children. This, therefore, becomes a subject upon which none can afford to be ignorant.

Although much has been written upon this subject by authorities all over the world, no one has so far undertaken to collect this scattered knowledge into one book, so that, in order to get a complete understanding of it in its physiological, medical, chemical and commercial aspects, it is necessary to refer to many text-books, journals and even note-books. Nor do the authorities all agree on many of the vital points concerning the best methods of artificial feeding, and the various physiological phenomena which take place in that most fearfully and wonderfully made organism—the human body. In other words, this subject has not yet been reduced to a science.

We can best approach this question by beginning with the general subject of foods for man, touching upon the various kinds, their

use, their composition, and the process by which they are converted from their crude state into forms serviceable for the maintenance of life.

Food is that "which is eaten for nourishment." Man's food consists of animal, vegetable and mineral matter, and must supply a sufficient amount of proteids, carbohydrates, fats, mineral salts and water to completely repair the waste that is continually taking place and allow the organism to grow.

Various foods supply these elements in different proportions, and are useless or valuable according as they contain more or less of the essentials, and any food which possesses these five substances in proper proportions is capable of perfectly sustaining life, for each supplies the necessary material for the development of tissues, nerves, glands, juices, fat, bones, ligaments, etc., and for the maintenance of the bodily temperature, and the production of energy.

The proteids or albumenoids contain nitrogen and supply the elements for the foundation and repair of the tissues, brain, muscles, nerves, glands, blood corpuscles, and the resisting power against disease. Protoplasm, the centre of cell life, is formed of and nourished by proteids. They are therefore the most important elements in our food, and are the only ones, when used alone, that are capable of sustaining life.

They may be of animal or vegetable origin, such as egg, meat, milk and the gluten of cereals.

The fats and oils are second in importance, as they supply by combustion the heat necessary for the body, and without which the activity of the juices, the digestive ferments and many of the chemical reactions taking place in the body would be destroyed. They also are the main source of our energy, or, to use a crude simile, they are the oils burnt as fuel to keep the engine running. They may be of vegetable or animal origin, as lard, tallow, butter, olive or cotton seed oil.

The carbohydrates are the next in importance and are employed in the production of fat chiefly, although they also assist the fats in contributing to the production of heat and energy.

They also may be of animal or vegetable origin, although chiefly of the latter, as cane sugar, starch and milk sugar.

The salts supply the chemicals necessary for the formation of

bones and the juices, and are derived from both animal and vegetable sources.

Water is the last but not the least in importance, as about 70 per cent. of our body weight is composed of it, and from 75 to 80 ounces per day is needed. It serves for diluting the fluids of the body, for moistening mucous surfaces, as a solvent for food and a distributor and regulator of heat, and enters into all chemical reactions that take place in the body.

There are very few foods which can be directly utilized by the human economy without first undergoing a process of physical and chemical change or digestion.

This process takes place in various stages in the alimentary canal. In the mouth the food is mechanically subdivided, ground up and masticated, in the stomach it is thoroughly mixed with the digestive juices and allowed to pass a little at a time into the intestines, where the valuable material is extracted and absorbed. In other words, in this great factory the mouth is the mill room, the stomach the laboratory, and the intestines the shipping department where the products are carefully selected, classified and distributed throughout the various parts of the body.

As the use of proper food is the source of our life and health, so the use of improper food may be the cause of disease, and in such cases the best cure is the removal of the cause by the substitution of proper feeding. Hence we see food acting in the double capacity of a means of nourishment and a medicine. It must not be confounded with medicine, however, which is a remedy for disease, but it is very convenient when we can, by selecting a proper food, promote life and cure disease at the same time.

A very large proportion of the diseases of children results from some form of insufficient or improper feeding, and as very often the evil effects then produced are carried on to maturity and show themselves in dyspepsia, indigestion, deformities, etc., the question of dietetics assumes a very serious aspect. It is for this reason that artificial foods have been received with so much favor by physicians, and the subject has received such careful consideration. It is very fortunate that so much is being said and done in this direction, for a practical knowledge of the feeding of infants and of the sick is of the most vital importance to mothers, nurses and the general public, and it is just as necessary to know what to avoid as what to eat.

Having taken up the question of foods in general, their composition, the importance, specific uses and the relative value of the five ingredients, proteids, fats, carbohydrates, minerals and water, let us consider the various forms of artificial foods on the market, remembering that they are valuable only as they supply the above essentials in the requisite proportions, in a form physiologically capable of digestion and sufficiently palatable to be eaten.

The first substitute that is naturally employed for this purpose, because of its similarity to human milk, and its accessibility, is cow's milk. For adults it can be used fresh and without dilution, and is employed very extensively in this way, but for infants it is generally diluted by the addition of two parts of water to one of milk.

Theoretically this is the best and most serviceable substitute that can be used, and for this reason milk laboratories have been established in the large cities of this country for the purpose of furnishing pure sterilized, modified milk of any desired proportion of casein, cream and lactose. The milk of goats, asses and mares has been employed as a substitute with some success, but owing to practical difficulties can never have any very extensive use. Cow's milk, no matter how carefully modified and prepared, cannot be taken by all children, largely on account of the following facts: The casein is present in a much greater proportion than in mother's milk, is not nearly as digestible, as it coagulates in heavy masses instead of the fine flocculent curd of human milk. It is deficient in milk sugar, contains many bacteria, including some pathogenic varieties, is acid in reaction, whereas human milk is persistently alkaline, and is open to the two practical objections, that it requires care in keeping, and trouble in modification and preparation.

It would be impossible to take up and describe each different food upon the market in detail, and do justice to all, so for purposes of study it will be most convenient to divide them into general classes.

The points which it will be worth our while to consider can best be taken up under the heads of composition, method of manufacture, and the advantages and disadvantages they seem to possess. It would be well to also bear in mind that the theories upon which the composition of the foods of commerce is based, although necessary to their existence and useful for advertising

purposes, are, nevertheless, not to be considered always as based upon fixed, definite and accepted laws, and the best food for a child or an adult is the food that, after many trials, gives the best practical results, no matter what theory it may represent, or what may be claimed for it. The old adage: "What is one man's meat is another's poison," is applicable to this condition, and the bare truth, established by practical experience, remains, that there is no artificial food which will infallibly suit every case.

Manufactured foods may be conveniently divided into the following classes: predigested foods, milk foods, cereals and complete foods.

By milk foods we mean those which are prepared from cow's milk, the chief representative of which is condensed milk. It is prepared by slowly evaporating off the water at a moderate heat in vacuo till the milk has assumed a syrupy consistence. There are many brands of condensed milk on the market, and may be of two varieties. The "plain," which is condensed to about one-fourth its bulk, with the addition of a small amount of cane sugar, and the "stronger," in which the condensation is carried further, and a much larger quantity of cane sugar is added, sometimes running as high as 70 per cent.

This makes a very cheap food and is easily prepared, requiring only dilution, and is quite palatable, and hence is used largely among the poorer classes. It is somewhat laxative in its effect, which is an advantage quickly realized by the nurse. Condensed milk, however, is not a satisfactory food for permanent use. Children fed on it thrive very well for a time and rapidly gain in weight, but the flesh formed is flabby, with large amount of fat, and it has a tendency in time to produce rickets, marasmus and general symptoms of malnutrition.

Another form of milk food is that which is prepared by predigestion by some ferment, such as pepsin or pancreatin. There are very few foods of this kind upon the market, as their field is very limited. They find their best use as a temporary expedient after surgical operations or where the alimentary tract is so impaired that digestion becomes impossible, and it is necessary to give some food which can be directly absorbed without any effort on the part of the invalid.

When, however, they are employed for permanent nourishment

they are detrimental and demoralizing, for they encourage the digestive functions to become lazy and finally rob these organs of their ability to obey the commands of nature. Thus we impair instead of developing and strengthening vital parts of the body.

There are also condensed creams and peptonized condensed milks on the market which combine the features of the two above classes, but are not very important.

Among the other foods of animal origin, although of more recent application, are those prepared from beef.

Of the many beef juices on the market it will suffice to remark that they furnish very concentrated nourishment, since most of the indigestible fibre, muscle sheaths, bloodvessels, etc., are removed in the process of manufacture, and water is driven off by evaporation. They have quite an extensive use, but mostly for adults, being very seldom used for children except as an addition to milk or other food.

Eggs offer a remarkably efficient form of nourishment, as they contain proteids and fat in a concentrated and assimilable form, are easily procured and prepared and quite palatable.

Fresh eggs have always been a very popular food for both adults and infants as an addition to milk and other kinds of diet.

During the last few years attention has been called to the value of eggs as a substitute for the indigestible casein in milk foods, on the grounds of their digestibility and nutritive value. There are three strong points in favor of the egg as an ingredient of artificial food.

(1) That when it is desiccated and finely powdered it is effectively preserved against decomposition.

(2) It forms very fine and flocculent masses on coagulation, and hence gives the greatest freedom to the digestive juices to act upon it, and

(3) That it exerts an active influence upon the mucous membrane of the stomach, allaying irritation and soothing inflamed surfaces.

The greater number of artificial foods belong to that class in which cereals are used as the basis.

These prepared farinaceous infant foods are made by the following methods:

(1) Application of heat alone.

(2) Digestion with malt or diastase combined with heat.

(3) Addition of animal matter to cereals after dextrinization.

The first class comprises all those foods made with cereals alone and intended to be used as modifiers of cow's milk.

Wheat, barley and oats are the grains used in their manufacture, and the starch present, often amounting to 75 per cent., is partly dextrinized by the cooking, cellulose and indigestible matter being more or less completely removed in the process. All that can be claimed for these foods is that they are a useful addition to cow's milk for adults and older children, but contain too large a percentage of starch to be of value for young children, as very few infants develop the ability to digest starch till the sixth month.

In justice, it must be said, however, that practical experience seems to show that a small percentage of starch is not only often digested by infants, but has a very beneficial, mechanical effect in increasing the peristaltic action, exerting a laxative tendency and aiding digestion.

The second class, the malted foods, had their origin in the theories, and are the result of the experiments of Liebig, and for that reason are often called "Liebig Foods."

They are made of equal quantities of wheat flour and barley malt with a little bran and about 1 per cent. of potassium bicarbonate added. These ingredients are mixed with water into a paste and allowed to undergo fermentation, which converts the starch into soluble carbohydrates, maltose and dextrin. The mass is then strained, pressed, extracted with water and evaporated, dried and powdered. In some of these foods a small percentage of starch still remains. The general characteristics of these foods are complete solubility, a strong and sweet taste, agreeable to most people, but which may, by constant use, become nauseating. They are easily assimilable, require little digestion and are quickly prepared. They are not complete foods, however, as they contain little or no fat and no animal proteid, although there is albuminous matter present in the form of gluten. They are, therefore, not to be used alone, but, like the first class, should be prepared with milk.

In the third class of foods an attempt is made to supply both vegetable and animal matter, or, in other words, to make a complete food; they are of the more recent manufacture and are the result of the practical experience of the manufacturers of the previous class of foods.

This class does not comprise a large number of products, but has

met with greater favor and is certainly a step in the right direction.

They are of three kinds:

(1) Such as are composed of an extract of barley and wheat, to which powdered, dried and predigested milk is added.

(2) Those composed of dextrinized cereals and unpredigested dried milk.

(3) Those composed of dextrinized cereals, sugar of milk and desiccated powdered egg.

The first kind, that made from predigested milk and an extract of cereals, is similar to the malted foods, having a strong and sweet taste, but is to be taken with hot water only, and hence is easily prepared, and has found a very extensive use, particularly among adults.

It, however, is deficient in fat, containing less than 1 per cent., and the presence of such a large quantity of sugar is likely to produce fermentation in the stomach and intestines. The effects of these foods are manifested by the rapid production of fat and a gain in weight, and children may even be reared upon them exclusively, but as they possess no antiscorbutic property they are likely to produce scurvy. Moreover, these foods are open to the same objections that predigested foods are, namely, that their ingredients, being converted into already assimilable forms, do not allow the digestive juices to perform their proper functions.

The second class seems to be open to less objection on this ground, as neither the cereals nor the milk are predigested during their manufacture. In other respects they resemble the preceding closely, except that they require cooking before administration.

The third form, foods made from dextrinized cereals and desiccated egg, rely upon the substitution of egg-albumen for the less easily digestible casein, the dextrinization of the cereals by a double process of cooking (first being boiled and then baked), and are milk foods only in this sense, that sugar of milk alone is present. They possess the following advantages over the others:

They are of a mild, palatable taste, not excessively sweet (as they contain no sucrose or maltose), the casein is replaced by the more digestible egg-albumen and they are not predigested. They are open to these two practical objections, that like the second class they require cooking in their administration and are also deficient

in fats. For this reason milk and cream must be added, the milk supplying the antiscorbutic property.

We have now covered all the classes of artificial foods and have discussed their composition and utility in the light of the laws laid down as the result of practical experience by the authorities on this subject, and in conclusion we find that they are all more or less useful, but that they all possess certain definite defects. That no one can tell whether a certain food will be successful in any certain case till it has been tried, and that, as we have said before, the best commercial foods are those which supply the five essentials in the requisite proportions, in a form physiologically capable of digestion and sufficiently palatable to be relished. It is clear, then, that since none of these foods meet all these requirements completely, the problem of artificial feeding has not yet been completely solved.

Yet one cannot glance through any of the best pharmaceutical or medical journals or literature of to-day without noticing the articles written on this subject by the most noted scientific men, and without realizing that science and art are combining their forces and exerting the greatest activity in the attempt to solve this problem.

Judging from the great interest that this subject has excited, not only among the scientific classes, but with the community at large, resulting in a universal demand for a perfect artificial food, and considering the unlimited resources of this country and its people, the great possibility of supplying this demand, and thus meeting our obligations to humanity, seems almost within our grasp.

LABORATORY NOTES.

By Charles H. LaWall and Robert C. Pursel.

The records of the analytical department of a large wholesale and manufacturing establishment are of great value in indicating the average quality of the goods upon the market. The publishing of such notes from time to time serves to keep other analysts posted on the character and extent of the adulteration noted, for when a lot of goods is rejected by one house the seller does not destroy the goods, but tries others until he disposes of them. Thus, it will be seen that adulterated articles eventually reach the retailer, and through him the consumer, and the only way of preventing this is the enforcement of the laws regulating the quality of various substances by establishing standards to which they must conform.

The increasing watchfulness of commercial houses who look after the quality of all articles supplied to their customers, together with the fact that at the present time graduates in pharmacy are thoroughly able to perform all the analytical operations necessary to determine the purity of the drugs and chemicals handled by them, has made it almost impossible for gross adulterations to exist, and it is very evident that adulteration is now done in a scientific manner by persons who are well informed as regards the tests applied to a given substance.

The following notes concerning some of the articles of common occurrence in commerce are not to be regarded as possessing any originality, but merely as a contribution which furnishes information of the commercial quality of the substances reported upon.

Flaxseed, both whole and ground, has frequently been reported as being below the standard of the U. S. Pharmacopœia in oil contents. The pharmacopœial requirements are that it shall not contain less than 25 per cent. of fixed oil when extracted with CS_2.

The following figures were obtained from the examinations of carload lots of the substance and show that there is some basis for the suspicion that the oil is partially extracted from the meal before placing it on the market. Three lots of whole flaxseed showed the following percentage of oil extracted by CS_2:

	Per Cent.
(1)	35·28
(2)	37·00
(3)	38·40

Average, 36·87 per cent.

Nine lots of the meal gave the following figures:

	Per Cent.
(1)	21·96
(2)	24·83
(3)	25·24
(4)	22·72
(5)	26·48
(6)	34·08
(7)	26·55
(8)	25·20
(9)	26·62

Minimum, 21·96 per cent.; Average, 25·96 per cent.; Maximum, 34·08 per cent.

Creolin first appeared on the market of a particular brand, designated Creolin-Pearson. Of late bulk lots have been examined

which vary greatly in specific gravity from the original product mentioned above.

	Sp. Gr. at 20° C.
Creolin Pearson	1·0422
Creolin.—(1)	1·0755
(2)	1·0752
(3)	1·0758
(4)	1·0748
(5)	1·0732
(6)	1·0768
(7)	1·0769
(8)	1·0780
(9)	1·0669
(10)	1·0675
(11)	1·0676
(12)	1·0651
(13)	1·0623
(14)	1·0643
(15)	1·0640
(16)	1·0734
(17)	1·0724
(18)	1·0691
(19)	1·0702
(20)	1·0692
(21)	1·0676

The range being from 1·0623 to 1·0780, which is noticeably higher than the original article. Average, 1·0711.

Gamboge.—A lot, aggregating 35,000 pounds, was examined recently, which fully complied with the U.S.P. requirements for absence of starch.

Belladonna Leaves.—Ten samples of belladonna leaves, for which the commercial standard of 0·40 per cent. alkaloid has been established, gave figures as follows:

	Alkaloid Moist by Acid Titration. Per Cent.	Moisture. Per Cent.	Alkaloid Dry. Per Cent.
(1)	0·343	7·74	0·372
(2)	0·310	9·06	0·343
(3)	0·370	8·18	0·404
(4)	0·375	7·65	0·407
(5)	0·260	9·54	0·289
(6)	0·430	6·62	0·460
(7)	0·371	8·80	0·407
(8)	0·264	9·20	0·291
(9)	0·220	8·67	0·241
(10)	0·313	7·75	0·340
Average	0·3227	8·32	0·3525

The low average would indicate that the standard had been placed too high for this drug.

A very material reduction in the time of assay was accomplished by titrating directly from the first chloroform-ether residue, as in the case of nux vomica. The presence of so much chlorophyl has always proved a hindrance to the successful performance of this method, as the end-reaction is totally obscured.

In the process used the first chloroform-ether extract was evaporated to dryness, and several portions of ether were added successively and evaporated, which removes all trace of ammonia. A small amount of alcohol is added and an excess of $\frac{1}{10}$ acid solution is run in from a burette, the amount being carefully noted. A large amount of water is now added and, lastly, about 10 or 15 c.c. of chloroform and the whole is well stirred. After several minutes' standing it will be found that the heavier chloroformic layer contains all of the fatty matter together with the chlorophyl and the supernatant aqueous liquid is practically colorless. The desired indicator may now be added and titration successfully carried out.

Potassium cyanide, a chemical much used in the arts, is one of the substances frequently giving the analyst trouble from the presence of some impurity which causes a darkening of the solution when titrated with silver nitrate v. s., thus obscuring the end-reaction.

Another difficulty encountered in reporting upon this substance is due to the presence of sodium cyanide, which requires a lower factor for calculating the per cent. when titrated, the result being that when titrated and calculated as KCN, more than 100 per cent. of that substance is indicated, exclusive of carbonates and moisture, which are always present to some extent. It is difficult to make some customers appreciate the fact that, while it is impossible for it to contain more than 100 per cent. of KCN, the presence of the sodium salt makes it equal to more than its own weight of KCN in actual working value.

The following figures show the range in KCN value of this article, the commercial having a standard of 30 per cent., and the U.S.P. 90 per cent.:

	Commercial. Per Cent.	U.S.P. Per Cent.
(1)	25·48	97·53
(2)	24·94	99·09
(3)	27·60	93·34
(4)	28·16	91·15
(5)	27·20	100·05
(6)	25·10	100·40
(7)	27·97	97·70
(8)	28·60	97·51
(9)	22·98	98·24
Average	26·45	97·22
Minimum	22·98	91·15
Maximum	28·60	100·40

Turpentine.—The turpentine examined during the past year conformed in nearly every instance to the U.S.P. requirements. The odor and general appearance are taken into consideration when passing upon samples of this substance, as well as the specific gravity, boiling point and other U.S.P. tests.

Twelve lots examined, aggregating about 400 barrels, gave the following results:

	Specific Gravity.	Boiling Point.	Residue.	Solubility.
(1)	·8590	155°–172° C.	slightly abnormal	O.K.
(2)	·8591	154°–170° C.	"	"
(3)	·8583	156°–170° C.	normal	"
(4)	·8661	155°–168° C.	"	"
(5)	·8630	150°–157° C.	"	"
(6)	·8572	156°–160° C.	"	"
(7)	·8561	158°–160° C.	"	"
(8)	·8564	155°–169° C.	"	"
(9)	·8555	155°–166° C.	"	"
(10)	·8651	156°–165° C.	"	"
(11)	·8651	155°–159° C.	"	"
(12)	·8306	80°–170° C.	abnormal	"
Average	·8523	149°–166° C.		

Sample No. 12 contained about 25 per cent. of gasoline. Also traces of rosin were found in the residue obtained upon the evaporation of a convenient quantity.

Yellow Wax.—Probably no article in the Pharmacopœia is adulterated to the extent that yellow wax is. A product can very easily be made up by using Japan wax, tallow, paraffin, stearic acid, carnauba wax, etc., in the proper proportions, which will have the specific gravity and melting-point conforming to the U.S.P., and

can only be distinguished from pure wax by applying other than the above tests.

The following table shows the results of twelve examinations:

	Specific Gravity.	Melting-Point.	Acid No.	Ether No.	Adulterant.
(1)	·9560	63° C.	19·08	72·13	
(2)	·9200	65° C.	7·34	17·48	{ Paraffin, Stearic Acid }
(3)	·9535	63° C.	22·15	78·82	
(4)	·9520	64° C.	21·45	77·08	
(5)	·9200	66° C.	5·30	27·63	{ Paraffin, Stearic Acid }
(6)	·9450	63·5° C.	19·40	78·99	{ Paraffin, Stearic Acid }
(7)	·9540	63° C.	20·16	87·14	{ Tallow, Carnauba Wax }
(8)	·9560	62·5° C.	21·30	83·53	Stearic Acid
(9)	·9600	64° C.	19·41	76·95	
(10)	·9558	63·5° C.	20·49	83·96	
(11)	·9620	64° C.	19·14	77·91	
(12)	·9400	68° C.	14·38	66·71	{ Paraffin, Stearic Acid }
Average,	·9479	64·08° C.	17·47	69·02	

Oil Sassafras.—On account of the large consumption of this oil by soap manufacturers, it is handled extensively by the wholesaler. Oil which has a gravity of less than 1·07 is looked upon with suspicion, as we have reason to believe that some of the safrol is extracted before the oil is put on the market. But one lot of oil has come under our notice during the past year that did not have the desired gravity. This was a lot aggregating about 400 pounds, and had an average gravity of 1·0573.

RECENT LITERATURE RELATING TO PHARMACY.

NEW FALSE CINCHONAS.

C. Hartwich elaborately describes (*Arch. der Pharm.*, 1898, 641) four barks recently placed on the market as cinchona.

The first, designated as South American "pseudo-china," was found identical with "china bicolorata," first noticed by Brown in 1793. The writer traced its source to the genus Antirrhœa, N. O. Rubiaceæ, and it is apparently from the species aristata. This diagnosis is based on the presence of "stabzellen," and of silica crystals in the cells of the medullary rays, as well as the thickened cell

walls of the phelloderm. The bark contains an alkaloid—not, however, quinine or cinchonine. Moreover, it does not respond to Grahe's test. The second, called "china cuprea," while closely resembling cuprea bark, is not the product of a Remijia, but seemed a species of Buena. It contained no alkaloids, had the red brown color of cuprea barks, but differed microscopically by the form of the milk vessels in the primary bark, by the two sizes of sclerotic cells in the secondary bark and by the spindle-shaped cells in the base.

The third, which came from St. Domingo, was astringent and contained no alkaloid. Its microscopical structure indicated it did not even belong to the N. O. Rubiaceæ, as shown by the presence of large quadratic crystals of calcium oxalate. The peculiar medullary rays, occasionally but one cell wide and then at times greatly broadened, suggested its relationship to the genus Bucida, N. O. Combretaceæ.

The fourth was introduced as "cortex chinæ von Colombia." It contains neither tannin nor alkaloids, is in the form of quills, of yellowish-gray-brown externally and dark brown on the inner surface. Its origin could not be traced by microscopical means.

Mixed with it was another bark resembling it closely, but astringent. The axillary lengthened secretion receptacles, the calcium oxalate glands in the medullary rays and the primary bast bundles —all point to its origin from the genus Croton, possibly *C. Malambo.*

H. V. Arny.

CONSTITUENTS OF FRANGULA, RHUBARB AND SENNA.

At the last meeting of the pharmaceutical section of the Swiss Society for the Advancement of Science, Dr. Aweng reported investigations on the three drugs above mentioned (*Schw. Wochensch. für Chem. und Pharm.*, 1898, 445).

Frangula, by extraction with 60 per cent. alcohol, evaporation and treatment of extract with water, yielded two glucosides; one (primary) soluble in water, the other (secondary) insoluble. The yield of these was 20 per cent. and 12 per cent., respectively. Both, on hydrolysis, yielded, besides sugar, chrysophanic acid, emodin and a substance resembling Liebermann's rhamnetin, in all save greater solubility in alcohol. This body, which was crystallizable from alcohol and acetone, and sublimed in yellow needles, the author names Frangularhamnetin. The fourth product of

hydrolysis was a principle soluble in alcohol and containing iron. This the author calls "Eisen emodin."

Of these four products, he finds only chrysophanic acid and emodin cathartic.

Fermentation causes a change of the scarcely bitter, water-soluble primary glucoside into the very bitter, water-insoluble secondary. As the primary water-soluble compound has less objectionable taste than the secondary, is present in larger amounts, and is almost as potent, the author recommends aqueous preparations of frangula. He finds a glycerite, made by dissolving aqueous extract in glycerin, particularly effective.

From rhubarb he isolated, by similar treatment, two glucosides, one soluble in water and the other insoluble, similar to those from frangula. The relative quantity of the two products depends on the quality of the drug, the finest Shensi yielding 40 per cent. of the primary and 5 per cent. of the secondary glucoside, while Rheum rhaponticum yields 25 per cent. of primary and 37 per cent. secondary. Likewise from senna, he isolated similar primary and secondary glucosides. These bodies, however, differ from the rhubarb and frangula glucosides by hydrolyzing only to emodin and frangula rhamnetin, or a close ally. H. V. A.

EDITORIAL.

PHARMACEUTICAL EDUCATION.

It must be apparent to every one that the matter of education is, like that of success, dependent very much upon the individual. Good men graduate from poor colleges and poor men graduate from good colleges. As to what constitutes a true or proper education there are great differences of opinion. Very recently, at the commencement exercises at Cornell University, Governor Roosevelt said that collegiate training offers innumerable advantages to any one and said that college-bred men are the leaders. He did not say what kind of a college education made it possible that "our country could better afford to lose all of the men who have amassed millions than to lose one-half of its college-bred men." Nevertheless, it must be apparent that the colleges in this country that are not giving an adequate education for the general average training to their students are the exception. President Low, of Columbia University, in an address of welcome some time ago to the associates of colleges and preparatory schools of the Middle States, referred to the success of the navy in the late war as a proof of the value of educational training. The work of the navy, he said, was exceedingly effective, and that work was the result of schools where officers and men had been carefully trained in the special branches of their duty. If education can fit men to fight so successfully, he argued, it can fit men for any other purpose in life. Surely educational methods must be

better, judging from results, than many would have us believe. There is a feeling in the West, judging from what one college President is said to have said, that no college having an endowment of less than $100,000 should be allowed to confer degrees. A prominent pharmacist is also quoted recently as having said that "what we need is fewer, but better pharmacists; not more schools, but fewer and better ones—schools that can afford to refuse, and will refuse to accept material not ripe for college work." "If," said he, "the United States had only four colleges not dependent upon political sandbaggers, nor upon the number of matriculants, but in a position to write over their portals, 'no one enters here but men who have learned to learn,' pharmacy would soon be an occupation worth following and worthy of the ambition of any young man." It will not be possible to discuss these remarks at any length. The increase in the number of colleges is dependent upon and results from the increase in population. It may be said that all legitimate schools are endeavoring to select their students and graduates not necessarily only at the entrance, but before their graduation. Each matriculant and student is having his work critically examined, and his record is based not so much on the number of correct answers, but rather on the nature and quality of these answers. It may be further said that all legitimate schools are endeavoring to be so provided by endowments that the most unselfish work may be done by teacher and the most rigorous requirements fulfilled by students. The time is not yet ripe to say that colleges must have a certain endowment, or that only they who have "learned to learn" shall be admitted. We must still do the best we can without liberal endowments and try to teach our students so as to make them competent. To put on the screws just now in the utopian fashion suggested would be worse than a bread famine or even the evils that are to be remedied.

The same speaker pleads "not for higher, but lower and broader education." As to what this speaker meant by lower and broader education is not given in the account of the address we have seen. But here again we might all differ. It is said of Russell Sage that he has always devoted about a month of each year to the study of current politics, as he has found that in no way can a man gain such useful knowledge of his fellows as he can by working in politics. Thomas Edison, the inventor, has said that if you want to succeed get some enemies. And so it goes. The problems of education, like success, are, as we have said, largely individual. One requires certain traits developed; another develops certain qualities easily, and some may never attain to any success. It is astonishing, however, as to how we differ about the terms higher and lower. The speaker advocates putting the bars so high up that only those who have learned to learn may enter, and then he would have a lower education. It seems to us that our better colleges are trying to do better than this, if not just the right thing. The universities like Columbia and Chicago, referred to and others, are putting their entrance examinations sufficiently high for the studies they teach and the objects of these institutions. Their aim is not lower but higher education. In colleges of pharmacy the entrance requirements are being made to correspond with the subjects treated. Can we realize how broad the education in our colleges of pharmacy is becoming? Mathematics, Latin, bacteriology, urinary analysis, commercial analysis are being taught, and even commercial training has recently been instituted in one college. The object of the latter course being, as stated in the announcement just issued, that "no matter how

thoroughly a student is educated scientifically and professionally, he may fail to realize the value of such education if he remains ignorant of proper business methods." The subjects to be treated of are enumerated, and then follows the statement that "no effort will be spared to cover every commercial point of the education of the pharmacist that will make him not only a valuable assistant, but fit him as far as possible for the responsible duties of a proprietor." Surely this is an education that, in connection with the other courses offered, may be considered broad enough—broad enough to qualify the graduates to become valuable assistants and responsible proprietors.

It may seem sometimes to the practical pharmacist, who is perplexed with the multitudinous things he has to do, that there must be a better way for him and for his clerks to travel. It may seem sometimes that pharmacy is an unfortunate calling, with many trials and perplexities, and few pleasures and rewards. But look around and see the bright and dark sides to every vocation. We remind those who would change existing things that things are changing, and that desirable things are being done. A great many minds to whom are entrusted the responsibilities of pharmaceutical education are quietly considering the problems of pharmaceutical education in all its phases. The light in the sky is already appearing, the clouds are rising higher and higher on the mountain side, and the students of pharmacy are ascending year by year to higher flights than those who preceded them yesterday, and they follow their teachers (and the schools) who it sometimes may seem are working in the clouds of impenetrable impracticability, yet who, nevertheless, when the light shines, are seen to be laboring for the real benefit and the lasting future of pharmacy.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

EINFÜHRUNG IN DIE PRAKTISCHE NAHRUNGSMITTELCHEMIE, bearbeitet von Dr. H. Thoms, Prof. in Berlin; mit einem Anhange: Botanisch-mikroskopischer Theil, bearbeitet von Dr. E. Gilg, Privatdozent d. Botanik in Berlin. Mit 115 Abbildungen. Leipzig: S. Hirzel. Gr. 8vo, 415 p.

There can scarcely be any doubt on the point that, in the majority of civilized States, serious studies and rational laws for promoting general sanitary welfare are just now in the first rank of public interest. And, to do justice to this well-founded desideratum of modern times, systematic chemical examination of food-materials belongs to the most active and hopeful means. In consequence, this branch of applied chemistry, in these last ten years and present days, is going on to be more thoroughly cultivated in the laboratories of universities and higher technical schools, especially in connection with pharmaceutical and medical university training. In fact, among men devoted to the so-called liberal or scientific professions there is, as we may fairly assert, no class more and better adapted to the pursuing of this kind of chemical and hygienical work than that of pharmaceutical chemists, who, by their early practical contact with different parts of natural history and exact natural sciences, and by the later academical studies and simultaneous training in chemistry, physics, botany, mineralogy and materia medica or pharmacology, ought to be admirably prepared and in the most favorable condition for the chemical study and detection of food adulteration. It is well known, at least

on the Continent, that the number of scientifically trained pharmacists engaged either as members of the sanitary commissions in towns or as directors and chemists in the State laboratories for food-examination, is very considerable, and will probably remain so, provided the pharmaceutical chemists do not themselves neglect this important department of their scientific education. Of course, the mentioned state of things has given rise to a pretty large flood of specified literature, viz., of ampler and shorter text-books containing the chemistry of food-materials, as well for beginners in this part of applied science as also for expert students and practitioners desirous of consulting an authentic guide in the difficulties of food-analyses. Yet a rather large number of these compendiums on food-chemistry, although containing numerous and detailed descriptions of all the newer methods of analyzing the different objects, viz., the liquid and solid materials, as wine, milk, fats, bread, etc., are in want of a really systematic instruction adapted to the comprehension of students entering into this field of analytical chemistry. The above-quoted text-book of the two German authors, in fact, deserves to be called an "introduction to the practical food-chemistry," and claims in the first line to be used for teaching purposes in the laboratory. First of all, it differs from many other similar works in containing two parts, viz., a chemical part and a section for the botanical and microscopic examination of food-materials. The first chemical part, owing to the principles just mentioned, begins with the description and explanation of all more important general methods of chemical testing and determination of certain bodies, like nitrogen, water, ashes, fat, tannic acid, alcohol, volatile oi's, sugar, albuminoids, etc.; the following second division of the chemical section contains all the data and methods concerning the chemical testing of the chief food-materials and drinks. It has been the aim of the authors to care for a selection of such newer methods which are of real value for students, and which, by practical experience of the last years, have proved relatively faultless and reliable.

Both chemical sections of the book are freely illustrated by well-executed woodcuts, and followed by a series of tables for calculations.

The second part of the book, botanical and microscopic, has been founded on the same plan, beginning with a short explanation of the methodic examination of the vegetable tissues of food-substances, and proceeding then to the anatomical characters of raw and powdered materials, as, for instance, coffee, tea, cocoa, pepper, saffron, ginger, mushrooms, etc. The text of this part also, as may be expected, is not devoid of good illustrations, which, together with an excellent print, do every justice to the blameless typographical quality of the present book. We think this truly practical compendium will be observed and gain friends also among American and English pharmaceutical chemists conversant with German language. ED. SCHAER.

STRASSBURG, GERMANY, June, 1899.

ANNUAL AND ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE.—By Charles E. de M. Sajous, and one hundred associate editors, assisted by corresponding editors, collaborators and correspondents. Illustrated with chromolithographs, engravings and maps. Vol. III. Philadelphia, New York and Chicago: The F. A. Davis Company, Publishers. 1899.

The first two volumes have been reviewed at length in this JOURNAL. The

articles in Volume III extend from Dislocations to Infantile Myxœdema. The plan of giving special space to subjects calculated to elucidate, by the close analysis involved, many obscure phases of pathogenesis, has been continued in this volume. The articles on "Infantile Myxœdema (Cretinism)" by Professor Osler and Dr. Norton; "Exophthalmic Goiter," by Professor Putnam, and "Goiter," by Professor Adami, thus form a trio which may be said to point to much of the progress that is to attend medicine in the near future. The practical value of the work is particularly shown in the article on "Dysentery," by Dr. Fleyner; on "Endometritis," by Professor Byford; on "Dislocations" and "Fractures," by Professor Stimson and Dr. Keyes, Jr.; on "Gout," by Dr. Levison; on "Hip-Joint Diseases," by Reginald H. Sayre; on "Eczema," by Professor Stelwagon. A specially attractive feature is observed in the analytical study of "Hysteria" and "Hypnotism," by Professor Eskridge. The same favorable comments accorded the previous volumes in this JOURNAL may be accorded Volume III. The work is in line with the advances of the times, and represents the results of experiences and thoughts of master minds. It is full of practical information and very suggestive material.

THE NEWER REMEDIES.—By Virgil Coblentz. Third edition. Revised and very much enlarged. Philadelphia: P. Blakiston's Son & Co., 1012 Walnut Street. 1899. Price, $1.

This volume contains considerable information that is desired by the pharmacist and physician upon the newer remedies. The articles are all arranged alphabetically, and include information concerning their synonyms, sources, methods of preparation, tests, solubilities, incompatibles, medicinal properties and doses as far as known. There are also sections on organo-therapeutic agents and indifferent compounds of iron.

Professor Coblentz was wise in making a special study of the newer remedies some years ago, and has followed the subject very thoroughly ever since. Up to 1896 there were about 800 synthetic medicaments in all. During the last three years alone there have been added about 1,200 more, so that the future of this subject is beyond all conjecture. The difficulty for the pharmacist and the physician is to secure reliable information concerning the newer products. Professor Coblentz has sifted the literature very well, and we have here a work which may be considered to be as safe and reliable as it is possible for a work of this character to be at the present time.

MERCK'S 1899 MANUAL OF THE MATERIA MEDICA.—Together with a Summary of Therapeutic Indications and a Classification of Medicaments. A Ready Reference Pocket Book for the Practising Physician. Compiled from the most Recent Authoritative Sources, and published by Merck & Co., New York.

The work is intended to be a "Ready Reference Book" on the chemicals and drugs usually employed in modern medical practice. Part I contains information upon the common synonyms, physical properties, solubilities, percentage strengths, physiological effects, therapeutic uses, modes of administration and application, regular and maximum dosage, incompatibles, antidotes, precautionary requirements of all the substances and preparations which are treated in the work. Part II contains a summary of therapeutic indications for the employment of remedies, arranged according to the pathologic conditions to be

combated. Part III presents a classification of medicaments in accordance with their physiologic actions.

The work has been carefully prepared, and contains just the kind of information that the physician is constantly requiring in his practice. It is a book, too, that the pharmacist can very profitably employ. The form and size of the book are such that it can be easily carried in the coat pocket and used by the physician, pharmacist or student in "brushing" up his memory whenever opportunity presents.

PRACTICAL MATERIA MEDICA FOR NURSES and an appendix containing poisons and their antidotes, with poison emergencies, mineral waters, weights and measures, dose list and a glossary of the terms used in materia medica and therapeutics. By Emily A. M. Stoney. Philadelphia: W. B. Saunders, 925 Walnut Street. 1899.

This work consists of the notes of a series of lectures delivered by the author, and includes only the source of the drugs, their action and uses, dosage and the symptoms and treatment of poisoning. It seems a pity that when there are so many books of a practical character the author should have spent her time in preparing this work which contains nothing that is new, and it can hardly be said that it either reflects or is intended to encourage the desire for accurate knowledge. Neither is there an attempt to follow a system or even stick to the plan of the book. We presume that what the author meant by source of drug is the origin as given in the Pharmacopœia. In some cases this is partly done, as under "Stramonium Leaves" and "Stramonium Seed." Under "Conium" the author says "the leaves and fruit of 'Conium Maculatum' is an antispasmodic and calmative." Then follow the doses of the extract and fluid extract of Conium. Under "Lemon Peel" all that is said is that "it is used for flavoring purposes." Then in the same sentence comes "Action and Uses.—Internally, lemon juice is a refrigerant and forms a refrigerant drink," etc. Instances of this character are common throughout the book. The definition of Materia Medica in the "Introductory" is very different from that given in the "glossary." The origin of Kola is given as "Sterarbia Acuminata." Under "Taka-Diastase" the following information is given: "A ferment produced by the action of Japanese rice-fungus; used as a disinfectant." "Cetrarin" is defined as "an alkaloid from Iceland Moss." These instances are sufficient to justify what was said in the first part of this review.

PRACTICAL METHODS OF URINE ANALYSIS.—For chemists and druggists, with notes on the composition of the normal and abnormal renal secretions. Published at the offices of *The Chemist and Druggist*, 42 Cannon Street, London, E. C.

That there is a growing importance to the physician and patient that the urine of the latter be analyzed is observed in the numerous works on urine analysis being published and the extent to which, in some of our text-books, a chapter on urine analysis is added. That the analysis of urine, from both a chemical and microscopical standpoint, is a legitimate field for the pharmacist is evidenced by the demand for instruction in this particular field. The book before us is a fairly accurate, clear, simple and practical treatise on this subject. With the exception of those portions treating of the spectroscope and polari-

scope, it may be said to be useful for the beginner who has no opportunity for instruction. We consider it, however, far more desirable for the analyst, if at all possible, to obtain a course of instruction under a competent instructor and make for himself a series of type slides of urinary sediments, etc.

AMERICAN PHARMACEUTICAL ASSOCIATION.

The following circular has been issued by the Section on Scientific Papers of the American Pharmaceutical Association :

Members of the American Pharmaceutical Association are cordially invited to present communications at the meetings of this Section to be held at Put-in-Bay, September 4th to 18th next. The attention of contributors is respectfully directed to the resolution adopted at the last meeting, to the effect that the official printer is requested to return to the author any paper or papers not bearing the approval of the Chairman of some Section of the Association.

The printing of papers previous to their reading is optional with the authors, but no paper can be received for this purpose later than August 8th.

Attention is also called to the resolution of 1895 (Proc., xliii, 236) requiring that any paper, the reading of which would require fifteen minutes or more, be read in abstract.

The list of queries here proposed is but brief, as it appears that contributors usually prefer to select their own subjects. Papers may be sent to any member of the Committee :

H. H. Rusby, *Chairman*, 115 West Sixty-eighth Street, New York.

H. V. Arny, *Secretary*, 107 Streator Avenue, Cleveland, O.

W. L. Scoville, St. Botolph and Garrison Streets, Boston, Mass.

(1) Is it practicable to provide an illustrated set of color-standards in the U.S.P.?

(2) Is it practicable to provide a set of odor-standards in the U.S.P.?

(3) Methyl alcohol corresponds very closely to ethyl alcohol as a menstruum for drugs ; what objections can be made to its employment in making solid extracts?

(4) Glycerin aids materially in preserving hydrocyanic acid and spirit of nitrous ether ; is its use desirable from a dosimetric and therapeutic point of view?

(5) Is it proper to make belladonna preparations from Scopola in the face of the present U.S.P. definition? Should the U.S.P. change its definition so as to sanction the use of this rhizome as an alternative?

(6) Is physiological action requisite as a department of pharmaceutical research?

(7) What is the effect of the high price of ipecac upon the quality of ipecac preparations supplied?

(8) Many imported drugs, such as opium, lactucarium and saffron, could be cultivated in the United States were the question of wages eliminated. An investigation into the feasibility of such culture on the convict farms of several States of the Union is desired.

(9) To what extent are medicinal plants cultivated in the United States?

(10) How can Syrupus U.S.P. be best obtained of a uniform quality and density without undue cost?

(11) Potassium and sodium acetates frequently contain a large amount of free acid. Samples containing more than 10 per cent. of free acid have been obtained. What is the reason of this?

(12) Recent research seems to show that the coloration of syrup of ferrous iodide and syrup of hydriodic acid is not due to the separation of free iodine. Further work on this subject is desired.

(13) Is the U.S.P. 1890 process of preparing syrup of ferrous iodide as satisfactory as the process of 1880? A critical comparison is invited.

(14) A report on the quality of commercial syrup of ferrous iodide, with special reference to preservatives employed, is desired.

(15) What is the quality of calcium hypophosphite found in commerce? What influence has this on syrup of hypophosphites prepared therefrom?

(16) Is "old cascara" any better than "new cascara" for preparing a bitterless extract? A good formula for the latter is desired.

(17) Have ambergris and civet been relegated to the past in perfumery? There is evidence that they are not being used in the later extracts.

OHIO STATE PHARMACEUTICAL ASSOCIATION.

The Association met in annual session June 22d, 23d and 24th, at Put-in-Bay. The meeting was well attended and appears to have been a profitable gathering.

The President, J. H. Beal, made a number of recommendations in his annual address which were finally adopted by the Association. The most important of these recommendations were as follows: That the Association amalgamate with the National Association of Retail Druggists as a body; that the Association use its efforts to further the work of the Pure Food and Drug Congress to formulate and have passed uniform pure food and drug laws of such a character as will be consistent with the interests of retail druggists; that young men who desire to register as pharmacists shall be graduates of some reputable school of pharmacy; that each member of the Association procure a poison register, and register therein all sales of poisons; and that a committee be appointed to prepare resolutions to be sent to their Senators and representatives requesting them to secure a more equal distribution of the war tax, extending it to trade-mark and copyright goods.

A paper, on the "Registration of Poisons," was read by Theo. D. Wetterstroem, of Cincinnati; Prof. H. V. Arny, of Cleveland, gave a talk and demonstration on the manufacture of emulsions; and Prof. Joseph Feil, also of Cleveland, read a paper on the manufacture of spirit of nitrous ether.

The use of salicylic acid having been referred to in the report of the Committee on Adulteration and Sophistication by Prof. G. B. Kauffman, of Columbus, the Association adopted a resolution which was to the effect that, salicylic acid having been proved to be a valuable anti-ferment and harmless in minute quantities, it was the sense of the Association that the use of this preservative in reasonable quantities was not objectionable; and that the Legislative Committee of the Association be requested to exert their influence in securing more reasonable legislation in this direction.

The names of thirty-four applicants for membership in the Association were reported by the Executive Committee.

The following officers were elected for the ensuing year:

President, Alfred De Lang, Cincinnati; First Vice-President, Adam Schmidt, Springfield; Second Vice-President, H. F. Vortkamp, Lima; Permanent Secretary, L. C. Hopp, Cleveland; Permanent Treasurer, John H. Von Stein, Upper Sandusky; Executive Committee, John Byrne, Columbus, Chairman; A. Hare, Belleville, and J. C. Firmin, Findlay.

Hotel Victory, Put-in-Bay, O., was selected as the meeting place for 1900.

MINNESOTA STATE PHARMACEUTICAL ASSOCIATION.

The Association held its fifteenth annual meeting at the pavilion of the Lake Park Hotel, Lake Minnetonka, June 20 to 22, 1899.

The attendance, though smaller than in previous years, was good, and the meeting was marked by earnestness and enthusiasm.

In line with President Heller's suggestion, the Association voted that the war tax ought to be reduced to 1 per cent., and that it should be extended to all proprietary articles. Copies of the resolution are to be sent to Congress and to the National Association of Retail Druggists. The question of joining the N. A. R. D. was then discussed, and it was decided that the Minnesota Association should become a member of the National body. The incoming President was instructed to name a committee, consisting of one man from each judicial district through the State, which shall consider district societies and report to the next convention. It was decided to send one delegate to Washington to assist in the revision of the Pharmacopœia, and to elect five men, whose names shall be submitted to the Governor for appointment to the Board of Pharmacy.

D. R. Noyes, of St. Paul, made a brief address, in which he took a very optimistic view of present trade conditions. He thought department store competition would decrease as times grew better, and urged the necessity of putting the very best appearance possible on business and of keeping well up to date.

A very interesting talk on "Practical Hints in Pharmacy" was given by Thomas Voegeli, of Minneapolis. He contended that substitution was nothing but honest business competition so long as you frankly sell an article of your own in place of the patent medicine and do not attempt to imitate it.

J. C. Eliel, of the Wholesale Druggists' Association, also discussed substitution, claiming that the business was his who got it, providing that he got it honestly. He endeavored to demonstrate to the convention that if each druggist would buy the raw drugs and manufacture his own compounds, that the golden days of pharmacy would come again. Then the fight between the proprietary men and the retailers would cease, as there would no longer be any demand for patent medicines.

The elections resulted as follows: President, John Nielson; First Vice-President, B. O. Kyseth; Second Vice-President, Miss E. Williams; Third Vice-President, C. A. Jack; Secretary, E. B. Wilson; Treasurer, H. W. Rietzke (unanimously); Executive Committee, Messrs. Danek, Harrah and Hall.

Votes of thanks were extended to Senator Gausewitz and Messrs. Kelly, Nelson, Omlum, Johnson and McCollom for their services in the matter of the amendment to the pharmacy law.

OBITUARY.

JAMES M. FARR, manager of the New York branch of the well-known chemical manufacturing firm of Powers & Weightman, died at his home, on Lexington Avenue, in that city, on June 24th, after an illness of about three months.

The deceased was sixty-seven years of age, having been born in Philadelphia in 1832. He was the son of John Farr, one of the founders of the above-mentioned firm, and who was identified with the early manufacture of quinine products in this country, having as long ago as 1826 contributed an article to this JOURNAL, the title of which was "On the Extract of Quinine." It was therefore but natural that the son should take an interest in this branch of manufacture, he having aided very materially in the progress made in a commercial way.

As a young man Mr. Farr entered the employ of Powers & Weightman in this city, going to New York in 1865. He was associated with the firm during the remainder of his business career, with the exception of two years spent in Europe, whither he went in 1869.

Mr. Farr is survived by a widow and three sons.

He was highly esteemed by those who knew him, and has been spoken of as "amiable and gentle, courteous and considerate, upright and honorable."

PROFESSOR JEAN-FELIX JEANJEAN, the Director of the School of Pharmacy of Montpellier (France), died on the 17th of May, after an illness of some months' duration.

Professor Jeanjean was born in Montpellier on January 21, 1829, and had therefore attained the age ordinarily allotted to man. His education, which was classical in character, was obtained in the schools of his native city. Having early evinced a faculty for scientific study, in 1852 he was chosen an assistant in mathematics in the University of Montpellier. In 1853 he was promoted to the assistant professorship in the physical sciences, and in 1859 took charge of the course in physics. Meanwhile, through the advice of his uncle, the eminent chemist Balard, he took a course in pharmacy, graduating in 1857. After several promotions, he became professor of organic chemistry at the School of Pharmacy in 1868, and in 1894, in recognition of his long services, was chosen Director of that institution.

Professor Jeanjean made several noteworthy investigations in organic chemistry, and his toxicological researches brought him into prominence as an expert in questions of jurisprudence.

He was connected with the universities of Montpellier for forty-seven years, and well deserved the distinguished honors of which he was the recipient. In 1870 he was made an officer of the Academy, in 1878, officer of public instruction, and on June 10, 1896, was made a knight of the Legion of Honor, this being the occasion of the unveiling of the bust of his uncle Balard in the courtyard of the School of Pharmacy.